NEW FONTIERS

Presented to Workshop on Extreme Environments Technologies for Space Exploration

Pasadena May 14, 2003

Outline

- What is the New Frontiers Program?
- What are the Decadal Survey “Medium” Missions?
- What challenges does New Frontiers present?
- What is the status of the New Frontiers Program?

What is New Frontiers?

- It is a program for periodic selection and implementation of “medium” planetary space mission concepts
- As with Discovery, Explorer, and Solar Probes, missions are selected through Competition
- The New Horizons mission to pluto has been incorporated as the First NF mission

What is NF? Cont.

- Selection of an individual mission within a line does not require Congressional approval
- As with other mission lines, one has a promise to the community – frequent access to space
- Missions are cost capped

What is NF? Cont.

- New Frontiers will accomplish most if not all the scientific objectives identified for the 5 “medium class” missions identified in the recent Decadal Survey
- New Frontiers will solicit complete mission investigations of planetary systems science
- “Discovery Like”

What is NF? Cont.

- The Current Cost Cap is $650 M in FY 03 Dollars

- FY 2003 and FY04 President's Budget Requests (Real Year Dollars)
  - **FY 03: $ 15.0 M** - FY 07: $220.0 M
  - FY 04: $130.0 M - FY 08: $223.0 M
  - FY 05: $210.0 M
  - FY 06: $210.0 M

What is NF? Cont.

- Selections are Science Driven
- Principal Investigator and small team follows the mission from proposal through end of mission
- They remain responsible for the mission throughout its entire life cycle.

What is NF? Cont.

- Emphasizes managing to pre-defined cost limit, or “cost cap”
- Evidence that the mission will exceed the mission cap initiates a cancellation review
- Two-step selection process with final “Down Select” at the end of the Concept study

What is NF? Cont.

- Issuance of an Announcement of Opportunity (AO) every three years
- Independent Assessment Teams (IATs) will follow each project through the mission life cycle
- IATs provide an independent assessment of progress and risk at each major gate before the project may proceed to the next Phase

What is NF? Cont.

- The schedule is 47 m Months
- RTGs allowed
- Foreign participation can include the provision of the launch vehicle, but not if RTGs are required

What is NF? Cont.

- The Concept Development phase will likely be 7 months
- Concept Development support will likely be $1.2M.
- Launch vehicles include Boeing Delta IVH and the Lockheed Martin Atlas V

What is NF? Cont.

- First New Frontiers AO will likely include 4 of the Decadal Survey (DS) “Medium Mission” recommendations
- Proposers must address the science objectives of DS Medium Mission
- Proposers not limited to the DS “Straw Man” Mission for implementation

What are the Decadal Survey “Medium Missions”?

- **Kuiper Belt / Pluto (KBP)**
- **South Pole Aitken Basin Sample Return (SPA-SR)**
- **Jupiter Polar Orbiter with Probes (JPOP)**
- **Venus In-situ Explorer (VISE)**
- **Comet Surface Sample Return (CSSR)**

Missions: Key Scientific Questions:

South Pole Aitken Basin Sample Return (SPA-SR)

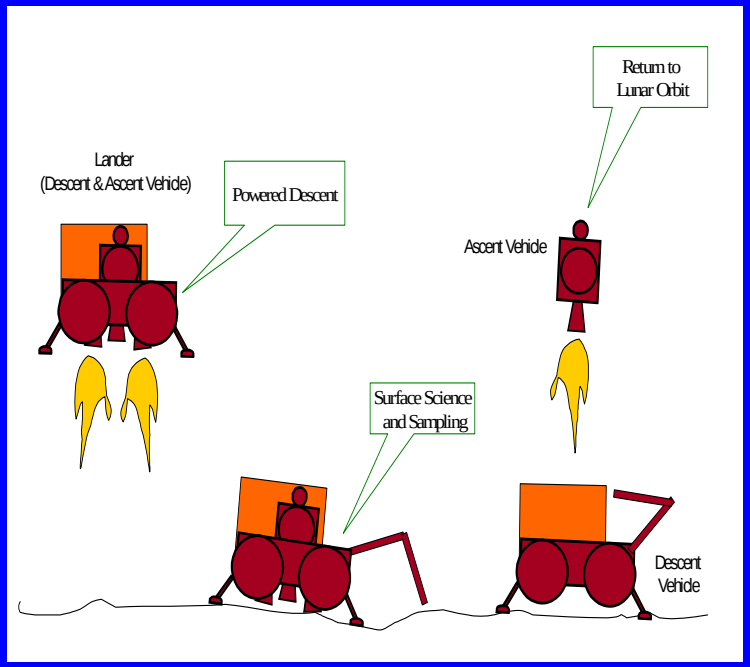
A mission to return samples from the solar system's deepest crater, which pierces the lunar mantle.

- **What processes marked the initial stages of planet formation?**
- **How did the impactor flux decay during the solar system's youth, and in what ways(s) did this decline influence the timing of life's emergence on Earth?**
- **How do the processes that shape the contemporary character of planetary bodies operate and interact?**

South Pole Aitken Basin Sample Return (SPA-SR)

GOALS:

- **Obtain samples to constrain the early impact history of the inner solar system**
- **Assess the nature of the moon's mantle and the style of the differentiation process**
- **Develop robotic sample acquisition, handling, and return technologies**



Missions: Key Scientific Questions:

Jupiter Polar Orbiter with Probes (JPOP)

A close-orbiting polar spacecraft equipped with various instruments and a relay for three probes that make measurements below the 100+bar level.

- **Over what period did the gas giants form, and how did the birth of the ice giants (Uranus, Neptune) differ from that of Jupiter and its gas-giant sibling, Saturn?**
- **What is the history of volatile compounds, especially water, across our solar system?**
- **How do the processes that shape the contemporary character of planetary bodies operate and interact?**
- **What does our solar system tell us about the development and evolution of extrasolar planetary systems, and *vice versa?***

Jupiter Polar Orbiter with Probes (JPOP)

GOALS:

- Determine if Jupiter has a central core to constrain ideas of its formation
- Determine the planetary water abundance
- Determine if the winds persist into Jupiter's interior or are confined to the weather layer
- Assess the structure of Jupiter's magnetic field to learn how the internal dynamo works
- Measure the polar magnetosphere to understand its rotation and relation to the aurora

Missions: Key Scientific Questions:

Venus In-situ Explorer (VISE)

A core sample of Venus will be lifted into the atmosphere for compositional analysis; simultaneous atmospheric measurements.

- **What global mechanisms affect the evolution of volatiles on planetary bodies?**
- **Why have the terrestrial planets differed so dramatically in their evolutions?**
- **How do the processes that shape the contemporary character of planetary bodies operate and interact?**

Venus In-situ Explorer (VISE)

GOALS:

- **Determine the compositional and isotopic properties of the surface and atmosphere**
- **Investigate the processes involved in surface-atmosphere interactions**
- **Elucidate the history and stability of Venus's atmospheric greenhouse**

Missions: Key Scientific Questions:

Comet Surface Sample Return (CSSR)

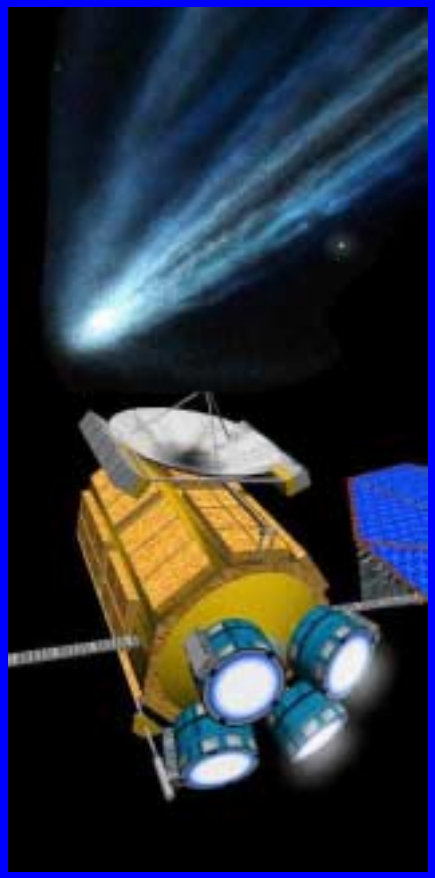
Several pieces of a comet's surface will be returned to Earth for elemental, isotopic, molecular, mineralogical, and structural analysis.

- **What processes marked the initial stages of planet formation?**
- **What is the history of volatile compounds, especially water, across our solar system?**
- **What is the nature of organic material in our solar system and how has this matter evolved?**
- **How do the processes that shape the contemporary character of planetary bodies operate and interact?**

Comet Surface Sample Return (CSSR)

GOALS:

- Return near-surface cometary materials to Earth for detailed compositional, isotopic, and structural analysis
- Assess the detailed organic composition of the cometary nucleus
- Assess the porosity and other physical properties of nuclear material
- Assess the physical relationship among volatiles, ices, organics and refractories and their relationship to porosity
- Assess the isotopic and mineralogic content at both microscopic and macroscopic scales assess the detailed organic composition of the cometary nucleus



What challenges does New Frontiers present?

Important NF Characteristics

New Frontiers missions are intermediate size missions—Larger than Discovery or Explorer– smaller than Cassini

Discovery	New Frontiers	Cassini
$300M	$650M	$3B

What challenges does NF present? Cont.

- **Several of the DS missions-- JPOP, VISE, CSSR– are technically challenging; yet these are cost-capped missions**
- **This will make the technical, cost and management review process during review and selection even more challenging than for Discovery**

What challenges does NF present? Cont.

- **Independent Assessment (IA) process will require larger (IA) teams, and they must be in place for longer periods**
- **We must establish a NASA Management Office**

What is the Status of the New Frontiers Program?

- **A draft Announcement of Opportunity (AO) is posted for comments**
- **We hope to have the final AO on the street by then end of June**

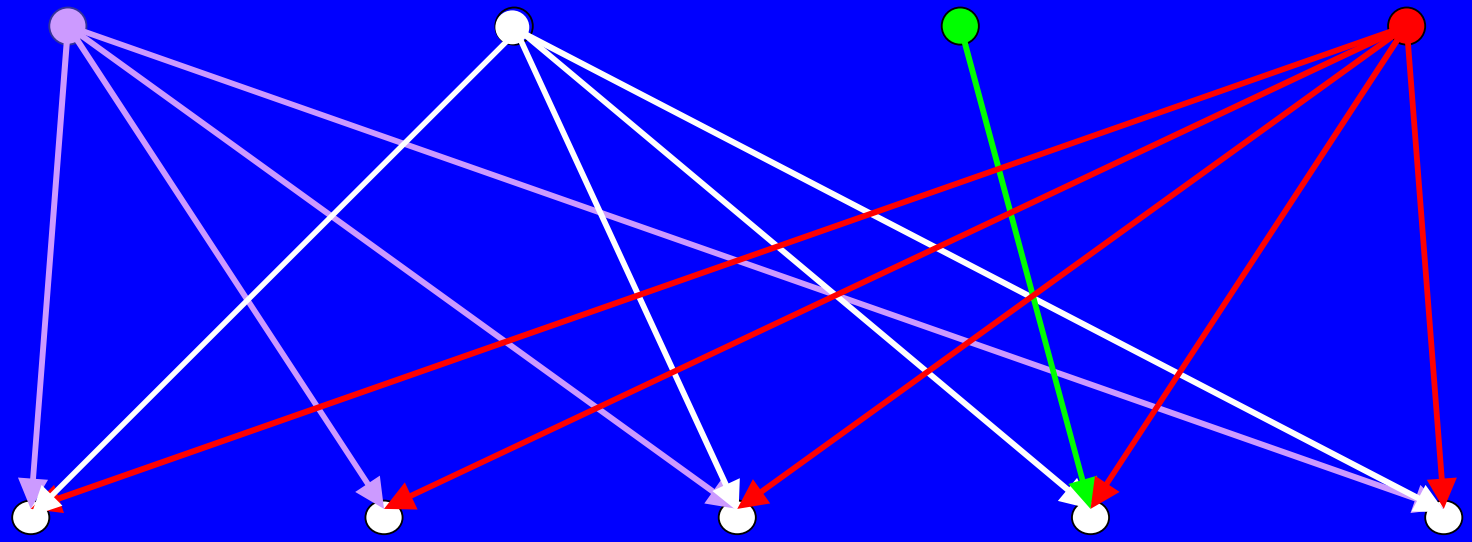
Backup Slides

Technology and New Frontiers

- **There is no separate technology line for the New Frontiers Program**
- **The technology needs for New Frontiers must be captured in the code S technology roadmap**

SURVEY THEMES

The First Billion Years of Solar System History	Volatiles and Organics: The Stuff of Life	The Origin & Evolution of Habitable Worlds	Processes: How Planets Work



1) Kuiper Belt-Pluto Explorer	2) Lunar South Pole-Aitken Basin Sample Return	3) Jupiter Polar Orbiter with Probes	4) Venus In-Situ Explorer	5) Comet Surface Sample Return

Increasing Technical Challenge

Missions: Key Scientific Questions:

Kuiper Belt / Pluto (KBP)

A flyby mission of several Kuiper Belt objects, including Pluto/Charon, to discover their physical nature and determine the collisional history of the Kuiper Belt.

- **What processes marked the initial stages of planet formation?**
- **How did the impactor flux decay during the solar system's youth, and in what ways(s) did this decline influence the timing of life's emergence on Earth?**
- **How do the processes that shape the contemporary character of planetary bodies operate and interact?**
- **What does our solar system tell us about the development and evolution of extrasolar planetary systems, and vice versa?**

Kuiper Belt / Pluto (KBP)

GOALS:

- **Investigate the diversity of the physical and compositional properties of Kuiper belt objects**
- **Perform a detailed reconnaissance of the properties of the Pluto-Charon system**
- **Assess the impact history of large (Pluto) and small KBOs**